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10/582,684	06/13/2006	Satoshi Aoyama	128268	4992

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EXAMINER	
KWON, ASHLEY M	

ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/582,684	Applicant(s) AOYAMA ET AL.	
	Examiner ASHLEY KWON	Art Unit 4111	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-14 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-14 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 13 June 2006 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 6/13/06.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

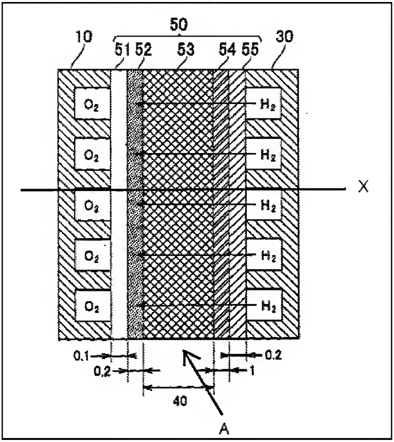
The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1- 9 are rejected under 35 U.S.C. 102(a) and (e) as being anticipated by Ito et al. (US Pat. Pub. 2004/0043277) (hereinafter "Ito").

Regarding claim 1, Ito teaches a fuel cell comprising: a plane of an electrolyte layer that has proton conductivity (51); and a hydrogen permeable metal layer (53, 54, 55) that is formed on the electrolyte layer that includes a hydrogen permeable metal (Vanadium, 53) (see fig .9).

Fig. 9

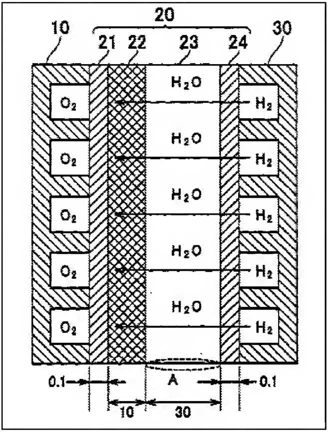


Ito fails to teach a fuel cell system including a higher temperature zone that is subjected to a high temperature and a lower temperature zone that is subjected to a lower temperature than the higher temperature zone, said fuel cell comprising a hydrogen permeable metal layer wherein the hydrogen permeable metal layer further includes a lower temperature area corresponding to the lower temperature zone and a higher temperature area corresponding to the higher temperature zone, and the lower temperature area and the higher temperature are have different settings of either or both of composition and layout of components.

However, it is common knowledge that the fuel cell has a high temperature zone closer to the hydrogen electrode (30) where the reaction takes place, and has a low temperature area closer to the oxygen electrode (10) where cooler air serves as an oxidizing gas. Therefore, in fig. 9, dense layer 53 can be viewed as the low temperature zone, and coating 55 can be viewed as the high temperature zone. Applicant's use of a high or low temperature **zone** versus a high or low temperature **area** is considered to be interchangeable since the area is within the zone and not defined to a certain region. With this in mind, Ito teaches a fuel cell system including a higher temperature zone (coating, 55) that is subjected to a high temperature and a lower temperature zone (dense layer, 53) that is subjected to a lower temperature than the higher temperature zone, said fuel cell comprising a hydrogen permeable metal layer wherein the hydrogen permeable metal layer further includes a lower temperature area corresponding to the lower temperature zone and a higher temperature area corresponding to the higher temperature zone, and the lower temperature area and the higher temperature are have different settings of either or both of composition and layout of components. The lower temperature area formed from vanadium and the higher temperature area is formed from palladium (see paragraph 57 and 58). Therefore this claim is anticipated.

Claim 1 is also anticipated by fig. 1 of Ito. Ito teaches a fuel cell comprising: a plane of an electrolyte layer that has proton conductivity (23); and a hydrogen permeable metal layer (21, 22, 24) that is formed on the electrolyte layer that includes a hydrogen permeable metal (V-Ni, 22) (see fig .1).

Fig. 1



Ito fails to teach a fuel cell system including a higher temperature zone that is subjected to a high temperature and a lower temperature zone that is subjected to a lower temperature than the higher temperature zone, said fuel cell comprising a hydrogen permeable metal layer wherein the hydrogen permeable metal layer further includes a lower temperature area corresponding to the lower temperature zone and a higher temperature area corresponding to the higher temperature zone, and the lower temperature area and the higher temperature are have different settings of either or both of composition and layout of components.

However, it is common knowledge that the fuel cell has a high temperature zone closer to the hydrogen electrode (30) where the reaction takes place, and has a low temperature are closer to the oxygen electrode (10) where cooler air serves as an oxidizing gas. Therefore, in fig. 9, dense layers 21 and 22 can be viewed as the low temperature zone, and dense layer 24 can be viewed as the high temperature zone. Applicant's use of a high or low temperature **zone** versus a high or low temperature **area** is considered to be interchangeable since the area is within the zone and not defined to a certain region. With this in mind, Ito teaches a fuel cell system including a higher temperature zone (dense layer, 24) that is subjected to a high temperature and a lower temperature zone (dense layers 21 and 22) that is subjected to a lower temperature than the higher temperature zone, said fuel cell comprising a hydrogen permeable metal layer wherein the hydrogen permeable metal layer further includes a lower temperature area corresponding to the lower temperature zone and a higher temperature area corresponding to the higher temperature zone, and the lower temperature area and the higher temperature are have different settings of either or both of composition and layout of components. The lower temperature area formed from vanadium and palladium, and the higher temperature area is formed from palladium (see paragraph 33). Therefore this claim is anticipated.

Regarding claim 2, Ito teaches a fuel cell in accordance with claim 1, wherein the hydrogen permeable metal layer has multiple layers of different hydrogen permeable metals in at least the lower temperature area, and the different settings of either or both of the composition and the layout of components in the lower temperature area and the

higher temperature area prevent potential deterioration of cell performance due to diffusion of the different hydrogen permeable metals between adjoining layers more actively in the higher temperature area than in the lower temperature area. Although in the embodiment represented by fig. 9 Ito teaches that dense layer 53 is composed of only vanadium, Ito also teaches that dense layers made of various materials can be applied to the solid polymer membrane fuel cell (see paragraph 39). Therefore, it would have been anticipated by a person of ordinary skill in the art that multiple layers of different hydrogen permeable metals could be used in place of one single layer. It is known that different metals will have differing hydrogen permeabilities (see paragraph 50). It is also common knowledge that molecules in a high temperature area have more energy than molecules in a low temperature area. Therefore metal in the higher temperature area are more likely to diffuse than metal in the lower temperature area. Since Ito teaches a metal diffusion suppression layer (54, see fig. 9) which prevents the diffusion of metals, between the high temperature area (55) and low temperature area (53), a person of ordinary skill in the art would have known that the metal diffusion suppression layer would more actively prevent diffusion of the higher temperature metal, since more of the molecules have the energy to diffuse, in order to prevent potential deterioration of cell performance.

Claim 2 is also anticipated by fig. 1. Ito teaches a fuel cell in accordance with claim 1, wherein the hydrogen permeable metal layer (21, 22, 24) has multiple layers of different hydrogen permeable metals (V-Ni) in at least the lower temperature area (22), and the different settings of either or both of the composition and the layout of

components in the lower temperature area and the higher temperature area prevent potential deterioration of cell performance due to diffusion of the different hydrogen permeable metals between adjoining layers more actively in the higher temperature area than in the lower temperature area. It is known that different metals will have differing hydrogen permeabilities (see paragraph 50). It is also common knowledge that molecules in a high temperature area have more energy than molecules in a low temperature area. Therefore metal in the higher temperature area are more likely to diffuse than metal in the lower temperature area. It is also well known in the art that vanadium has a higher rate of hydrogen permeation than palladium (see paragraph 40). Therefore, since only palladium is present in the high temperature zone (24), palladium's lower rate of hydrogen permeation more actively prevents the diffusion of hydrogen permeable metals than the low temperature zone (21, 22), which is composed of a layer of palladium and a layer of V-Ni. Since vanadium, which has a higher rate of hydrogen permeation than palladium, is also present in said low temperature zone, the low temperature zone does not as effectively prevent diffusion of hydrogen permeable metals as the high temperature zone.

Regarding claim 3, Ito teaches a fuel cell in accordance with claim 1, wherein the higher temperature area is set to have a lower level of hydrogen permeation, compared with the lower temperature area. It is common knowledge to a person of ordinary skill in the art that vanadium has higher hydrogen permeation than palladium (see paragraph 40). Since the higher temperature area (55) is composed of palladium and the lower temperature are (53) is composed of vanadium, there will be a lower level of hydrogen

permeation in the higher temperature area due to the inherent properties of palladium and vanadium.

Regarding claim 4, Ito teaches a fuel cell in accordance with claim 3, wherein the hydrogen permeable layer has a base material (53) that is made of a group 5 metal (Vanadium) or a group 5 metal containing alloy, and a coat layer (55) that is made of palladium or a palladium alloy and is formed on at least one face of the base material layer with a gas supply, and the higher temperature area has a lower content of the group 5 metal in the base material layer, compared with the lower temperature area. The high temperature area (55) does not contain any vanadium, therefore there is a lower content of the group 5 metal in the base material layer, compared with the lower temperature area.

Regarding claim 5, Ito teaches a fuel cell in accordance with claim 2, wherein the hydrogen permeable metal layer has a base material layer (53) that is made of a group 5 metal (vanadium) or a group 5 metal-containing alloy, a coat layer (55) that is made of palladium or a palladium alloy and is formed on at least one face of the base material with a gas supply, and a diffusion control layer (metal diffusion suppression layer, 54) that is placed between the base material layer and the coat layer in at least the higher temperature area to control diffusion of the different metals. It is clear from fig. 9 that there is a metal diffusion suppression layer (54) between the coat layer (55) and the base material layer (53). Since coating 55 is the high temperature area and the dense layer 53 is the low temperature area, said layering is present in both the high and low temperature areas.

Ito also teaches that the diffusion control layer is designed to inhibit metal diffusion more actively in the higher temperature area than in the lower temperature area. It is common knowledge that molecules in a high temperature area have more energy than molecules in a low temperature area. Therefore metal in the higher temperature area are more likely to diffuse than metal in the lower temperature area. Since Ito teaches a metal diffusion suppression layer (54, see fig. 9) which prevents the diffusion of metals, between the high temperature area (55) and low temperature area (53), a person of ordinary skill in the art would have known that the metal diffusion suppression layer would more actively prevent diffusion of the higher temperature metal, since more of the molecules have the energy to diffuse, in order to prevent potential deterioration of cell performance.

Regarding claim 6, Ito teaches a fuel cell in accordance with claim 2, wherein the higher temperature area (24) is homogenously made of palladium or a palladium alloy (see paragraph 33), and the lower temperature area has a base material layer that is made of a group 5 metal or a group 5 metal-containing alloy, and a coat layer that is made of palladium or a palladium alloy and is formed on at least one face of the base material layer with a gas supply. In fig. 1, Ito teaches an embodiment of his invention, where the lower temperature area (dense layers 22 and 21), has a base material layer (dense layer, 22) that is made of a group 5 metal or a group 5 metal-containing alloy (V-Ni), and a coat layer (dense layer, 21) that is made of palladium or a palladium alloy and is formed on at least one face of the base material layer with a gas supply (see

paragraph 33). This embodiment also has a higher temperature area (24) that is homogenously made of palladium (see paragraph 33).

Regarding claim 7, Ito teaches a fuel cell in accordance with claim 2, wherein the hydrogen permeable metal layer (21, 22, 24) has a base material layer (22), that is made of a group 5 metal or a group 5 metal-containing alloy (V-Ni), and a coat (21) layer that is made of palladium or a palladium alloy and is formed on at least one face of the base material with a gas supply (air) (see fig. 1, see paragraph 33)

Ito fails to teach the coat layer in the higher temperature area having a greater thickness than a thickness of the coat layer in the lower temperature area.

Ito teaches that both thicknesses of layers 21 and 24 are set to be 0.1 μm. However, Ito also teaches that the thickness of each of the layers can be set as chosen (see paragraph 33). It would have been within the ambit of a person of ordinary skill in the art to make the coat layer in the higher temperature area having a greater thickness than a thickness of the coat layer in the lower temperature area in order to more actively prevent diffusion of hydrogen permeable metals in the higher temperature area than the lower temperature area as explained above for claim 2.

Regarding claim 8, Ito teaches a fuel cell in accordance with claim 1, wherein the different settings of either or both of the composition and the layout of components in the lower temperature area and the higher temperature area inhibit hydrogen embrittlement under a low temperature condition more actively in the lower temperature area than in the higher temperature area. Ito teaches that vanadium has a higher rate of hydrogen permeation than palladium (see paragraph 40), and that vanadium is prone

to hydrogen embrittlement whereas palladium is resistant to hydrogen embrittlement. Therefore, the different composition of the lower and higher temperature areas inhibit hydrogen embrittlement under a low temperature condition more actively in the lower temperature area (which is composed primarily of vanadium) than in the higher temperature area (which is composed of palladium).

Regarding claim 9, Ito teaches a fuel cell in accordance with claim 8, wherein **at least** the lower temperature area is made of an alloy containing a hydrogen permeable metal (vanadium) and has a lower content of the hydrogen permeable metal (vanadium) than a content of the hydrogen permeable metal (palladium) in the higher temperature area. There is no vanadium in the high temperature area, so there is a lower content of it in the higher temperature area than the lower temperature area.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 10-12 and 14 are rejected under 35 U.S.C. 103(a) as being obvious over Ito in view of Jones (US Pat. No. 6,649,293).

Regarding claim 10, Ito teaches a fuel cell in accordance with claim 1, wherein the higher temperature area and the lower temperature area are formed on an identical plane of the hydrogen permeable metal layer. Since applicant does not define a specific plane, for the purpose of this rejection the plane will be defined as the plane along line X, annotated above in fig. 9. On this transverse plane, the higher temperature area and the lower temperature area are formed on an identical plane of the hydrogen permeable metal layer.

Ito fails to teach a fuel cell in accordance with claim 1 wherein said fuel cell is a unit cell of a fuel cell stack.

However, Jones teaches fuel cells connected together in series to form a fuel cell stack. The use of a known technique to improve similar devices (methods or products) in the same way is likely to be obvious. See *KSR International Co. v. Teleflex Inc.*, 550 U.S. __,__, 82 USPQ2d 1385, 1395 – 97 (2007) (see MPEP § 2143, C.). Therefore, it would have been obvious to a person of ordinary skill in the art to connect the fuel cells taught by Ito in series to form a cell stack in order to increase voltage and power output (*Jones*: see col. 1, lines 58-60).

Regarding claim 11, Ito in view of Jones teaches a fuel cell in accordance with claim 10, said fuel cell further comprising: a coolant flow path through which a coolant (air) passes, wherein the lower temperature area is provided in a region near to an inlet of the coolant into the unit cell, on the identical plane of the hydrogen permeable layer. A person of ordinary skill in the art would have known that the air provided to the fuel cell could serve as a cool air stream. Therefore, the air would serve as the coolant, and the oxygen electrode (10) is provided with a flow path for supplying air (see paragraph 32). The lower temperature area (53) is provided in a region near to an inlet of the coolant into the unit cell (see fig. 9), on the identical plane (represented as the plane along line X) of the hydrogen permeable layer.

Regarding claim 12, Ito in view of Jones teaches a fuel cell in accordance with claim 10, wherein the lower temperature area is provided in a region near to an inlet of a low temperature fluid (air) (see fig. 9) on the identical plane (represented as the plane along line X) of the hydrogen permeable metal layer (53, 54, 55).

Ito fails to teach a low temperature fluid having a temperature difference of at least a preset level from an average operating temperature of the fuel cell stack.

However it is within the ambit of a person of ordinary skill in the art to determine a preset level for a temperature difference for an average operating temperature of a fuel cell stack. Therefore it would have been obvious for a person of ordinary skill in the art to have a low temperature fluid having a temperature difference of at least a preset level from an average operating temperature of the fuel cell stack in order to have it operate more efficiently.

Regarding claim 14, Ito teaches a fuel cell in accordance with claim 10, wherein the hydrogen permeable metal layer has the lower temperature area provided at a position corresponding to an outer periphery of the fuel cell stack. In fig. 9 above, the arrow A pointing to the outer periphery of the fuel cell shows that the hydrogen permeable metal layer (53) in the lower temperature area is provided at a position corresponding to an outer periphery of the fuel cell stack.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ito in view of Jones as applied to claims 10-12 and 14 above, and further in view of Matsumura et al. (US Pat No. 5,993,984) (hereinafter "Matsumura").

Regarding claim 13, Ito in view of Jones teaches a fuel cell in accordance with claim 1, wherein a number of said fuel cells as unit cells form a fuel cell stack, and the hydrogen permeable metal layer (53, 54, 55) included in each unit cell of the fuel cell

stack has the higher temperature area (55) and the lower temperature area (53) according to a total temperature distribution of the whole fuel cell stack (see fig. 9).

Ito fails to teach that said fuel cells are unit cells **laminated** to form a fuel cell stack.

However, lamination of fuel cells to form a fuel cell stack is a common way of forming a fuel cell stack as evidenced by Matsumura (see col. 12, lines 13-17) and would have been obvious to a person of ordinary skill in the art.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ASHLEY KWON whose telephone number is (571)270-7865. The examiner can normally be reached on Monday to Friday 7:30 - 5pm EST with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Sines can be reached on (571) 272-1263. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

A.K.

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